

The equatorial Pacific climate and adjacent monsoon systems

Xiouhua Fu¹, Bin Wang^{1,2}, and Fei-fei Jin²

¹ International Pacific Research Center, University of Hawaii at Manoa, Honolulu, HI

² Department of Meteorology, SOEST, University of Hawaii at Manoa, Honolulu, HI

*Contact information:

Xiouhua Fu
IPRC, University of Hawaii at Manoa
1680 East West Road
POST Bldg. 4th Floor
Honolulu, HI 96822

Phone: (808) 956-2629

Fax: (808) 956-9425

Email: xfu@hawaii.edu

Web page: <http://www.soest.hawaii.edu/~xfu>

Background

We found that the adjacent continental monsoons (i.e., Asian-Australian monsoons and American monsoons) play important roles on rectifying the mean state and annual cycle of the equatorial Pacific (Fu and Wang 2003) with an intermediate air-sea-land coupled model. Without the effects of adjacent continental monsoons, the simulated mean SST in the western-central Pacific displays a warm bias; the SST annual cycle in the equatorial eastern Pacific exhibits an insufficient strength and two-month phase delay. The Asian-Australian monsoons act to cool the water in the equatorial western-central Pacific through enhancing the strength of the trades, thus drawing the model SST closer to the observations. The South American monsoon exerts profound impacts on the annual variations of the southeast trades, thus is an important external forcing of the SST annual cycle in the eastern Pacific.

Through examining the outputs of 10 AGCMs, we further found that the equatorial easterly is systematically enhanced in almost all the models. The exaggerated easterly is primarily caused by too strong monsoons in the west of the Pacific basin and too weak monsoons in the east of the basin. The monsoon-error-induced wind bias in the equatorial Pacific could considerably cool the ocean after invoking the Bjerknes' positive atmosphere-ocean feedback (Jin 1998). Therefore, the cold biases existing in some CGCMs could be a projection of the systematic errors in representing the adjacent monsoon systems.

Objectives

Our proposed study has two objectives. 1) To understand the relationships between the mean SST biases in the equatorial Pacific and the systematic errors in the adjacent monsoon systems. 2) Previous model inter-

comparison (e.g. Mechoso et al. 1995) revealed that many CGCMs have difficulty to well simulate the SST annual cycle in the eastern Pacific. We plan to examine the possible connections between the cold-tongue SST annual cycle and the South American monsoon in the CMIP coupled models.

Methodology

As we have done to the outputs of 10 AGCMs, first, we will document the collective relationships between the biases of the equatorial easterly (and SST) and adjacent monsoon errors in all CMIP coupled models. Then, we will examine the relationship between the biases in the equatorial Pacific and individual monsoon system; conceptual models may be used to understand the impacts of monsoon errors on the equatorial Pacific climate. Similar procedure will be used to examine the possible connections between the eastern Pacific SST annual cycle and the South American monsoon.

Data Requirements

1. CMIP Atmosphere

- Low-level winds
- Precipitation
- Geopotential height
- Surface fluxes

2. CMIP Ocean

- Upper ocean temperature (above 500 m)

References

Fu, X., and B. Wang, 2003: Influences of continental monsoons and air-sea coupling on the climate of the equatorial Pacific. *J. Climate*, **16**, 3132-3152

Jin, F. F., 1998: A simple model for the Pacific cold tongue and ENSO. *J. Atmos. Sci.*, **55**, 2458-2469.

Mechoso, C., and Co-authors, 1995: The seasonal cycle over the tropical Pacific in general circulation models. *Mon. Wea. Rev.*, **123**, 2825-2838.